THE UNIVERSITY OF ALBERTA

THE PREDICTION OF ACHIEVEMENT IN FIRST YEAR ENGINEERING

A DISSERTATION SUBMITTED
TO THE COMMITTEE ON GRADUATE STUDIES
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BY

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CHAPTER I

THE PROBLEM

The prediction of achievement at the university level is an important problem. In recent years overcrowded conditions in most faculties have made it advisable to take measures which would insure that the most promising candidates be admitted. Predictive studies can provide fairly reliable estimates of student abilities, capacities, and previous academic achievement and their relation to expected attainment in university. Such studies thus give substantial aid in the selection of prospective candidates. They also provide a basis for the guidance of the individual's studies into those channels which will yield him the greatest return for his efforts.

Limited facilities have made it necessary to restrict registration in the Faculty of Engineering at the University of Alberta. As a result the faculty has had recourse to admissions based on academic standing in the matriculation courses of the Grade XII examinations. It has been felt that other criteria might profitably be added. A more objective means of selecting prospective first year engineering students would conceivably eliminate many of those who are at present unable to meet academic standards and perhaps even those who lack sufficient interest to maintain their grades.

An attempt will be made in the present study to provide a more suitable means for screening prospective first year engineering candidates. The main problem will be to find to what extent certain

individual performance records can be used to predict academic achievement in first year engineering. It is further hoped that on the basis of this study worthwhile suggestions may be made for the guidance of future first year engineering students.

Academic achievement can never be predicted with perfect efficiency. In the first place, the tests upon which prediction is based do not give a complete picture of the quality or qualities which they are designed to measure. Further, there is often considerable variation in the performance of an individual on the same test at different times. These are merely limitations inherent in the measuring instruments themselves. Added to this there is no method at present available to control and evaluate motivation. Temporary emotional disturbances and many other subtle personality factors which affect performance tend to make individual prediction uncertain. Thus general trends should be sought in predictive studies and individual predictions should be made with caution.

CHAPTER II

RELATED STUDIES

Prediction of achievement at the college level is usually based on one or several of the following types of measuring devices:

a. Aptitude tests

b. Tests of mental ability

c. Achievement records and tests
   i. High school averages
   ii. Previous college records
   iii. Achievement tests.

The correlation coefficients which have been reported by various investigators for each of these categories appear in the tables below. Unless the prediction is concerned with achievement in engineering the school and faculty are not given.

TABLE I

CORRELATION COEFFICIENTS BETWEEN APTITUDE TESTS AND COLLEGE GRADES

Investigator	Test and Function	r
Crawford (5)	Scholastic Aptitude test (Yale) to predict freshman achievement.	0.46
Feder (9)	Foreign Language Aptitude test to predict first term French score.	0.71
Vaughn (16)	Yale Aptitude Tests to predict achievement in first year engineering	
	1. Verbal Comprehension	0.31
	2. Artificial Language	0.36
	3. Quantitative Reasoning	0.50
	4. Spacial Visualization	0.39
	5. Mathematics Aptitude	0.51
	6. Mechanical Ingenuity	0.31

TABLE II

CORRELATION COEFFICIENTS BETWEEN TESTS OF MENTAL ABILITY AND FRESHMAN GRADES

Investigator	Test	r
Byrns (2)	Ohio State Psychological Test	0.43
Edds and McCall (7)	Otis Group Intelligence Scale	0.50
Schmitz (13)	American Council Psychological Army Alpha	0.58 0.58
Votau (18)	American Council Psychological	0.61

TABLE III

CORRELATION COEFFICIENTS BETWEEN ACHIEVEMENT RECORDS AND COLLEGE GRADES

Investigator	Test and Function	r	R
Byrns (2)	First term score to predict second term score	0.73	
Cohen (4)	High school averages to predict first year average in engineering. Achievement Tests in Mathematics and in Physics to predict first year average.	0.57	0.55
Crawford (5)	First term average to predict second term average. High school average to predict first year average	0.80 0.61	
Edds and McCall (7)	High school average to predict first year average.	0.65	
Schmitz (13)	High school average to predict first year average. Iowa Reading Examination to predict first year average.	0.64 0.57	

High school averages were reported as the best single criterion of college achievement by Edds and McCall (7), Cohen (4), Jones and Laslett (11), Schmitz (13) and Crawford (5). It was further stated by Crawford that high school averages are the most suitable index of motivation at present available. However, Douglas (6), Cohen (4), Byrns (3), Jones and Laslett (11), Vaughn (16), and Wagner (19) suggest that letter gradings for high school courses are not sufficiently accurate for predictive studies. Thurber (15) states that two-fifths of college students in the sophomore year were found to be in the same quartile as they were when they left high school. In a study by Crawford (5) it was found that more than two-thirds of the individual predictions, made on the basis of high school averages, differed by not more than four points from the student's actual grade-point average. Byrns (3) reports that predictions for students of low academic standing are more valid than those made for above average freshmen. The minimum high school requirement is attacked by Bolenbough and Proctor (1), Douglas (16), and Sorenson (14); who say that it permits as many inferior students as superior to enter college.

The best prognostic value was found by Feder (9), Hurd (10), and Wakeman (20) to be in those aptitude and achievement tests based on the subject in which the prediction is required. Further, Edmiston (8) reports that the most valuable aptitude tests are those which are based directly on work to come. Vaughn (17) and members of the Society for the Promotion of Engineering Education are at present constructing and validating the first form of an engineering aptitude test for high school students who wish to begin engineering study.

Lingren (12) states that interest inventories are not likely to be of any value in the prediction of academic achievement but that they may be useful as an interviewing aid.

Summary

Findings of investigators who have conducted studies concerned with the prediction of college achievement follow.

a. The best basis for the prognosis of first year college grades is the student's previous record of academic achievement, but correlations seldom exceed 0.70.

b. Aptitude tests prove most valuable as predictors when they are based directly on the work for which the prognosis of aptitude is required.

c. Investigators have found that high scores on predictive instruments do not predict academic success to the extent that low scores predict failure. In other words, a prediction of failure may be made with more confidence than one of success.

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CHAPTER III

EXPERIMENTAL DESIGN

1. GENERAL DESIGN

Immediately after registration in the 1948-49 session, prospective first year engineering students at the University of Alberta were given four tests designed to measure individual abilities, aptitudes and interests. The present study has been conducted to determine the value of these tests and of high school averages for predicting achievement in first year engineering. In treating the problem it was felt that each of the following factors should be given consideration:

a. The relationship between each test of the battery, which is made up of the predictive tests given and the high school averages, and the criterion of achievement in first year engineering.

b. Appropriate statistical measures to check the significance of the relationships.

c. The order of merit of the tests for predicting achievement in first year engineering.

d. A possible combination of test scores, with suitable weighting, to give a composite score which would predict academic achievement in first year engineering more efficiently than any one test of the battery.

e. Possible alterations in the test battery, on the basis of previous related studies and present findings, which would likely increase its value as a predictive instrument.

f. Use of the predictive test results for the selection and guidance of future first year engineering students.

2. THE TEST BATTERY

The battery to be evaluated is made up of data from high school records and from the four tests administered to first year engineering students at the beginning of the session. The results from these four predictive tests were compiled under the direction of Dr. H. E. Smith, Faculty of Education, University of Alberta. This set of tests was made up of the following:

a. Thurstone's Psychological Test of Mental Ability

b. Iowa Physics Aptitude Test

c. Iowa Mathematics Aptitude Test

d. Lee-Thorpe Occupational Interest Inventory.

There are scores available for eleven different categories of the Lee-Thorpe Occupational Interest Inventory. Of these only those under the headings 'Level of Interest', 'Computational', and 'Scientific' were used in this study, since they were considered most closely related to the engineering curricula. Thus the raw scores from the four tests made up six separate sets of data. The seventh set of data consisted of the arithmetic means of the individual Grade XII mathematics and science scores (Algebra 2, Trigonometry and Analytical Geometry, and two of Chemistry 2, Physics 2, and Biology 2).

Since the space taken by table headings must be limited, the tests of the battery will be referred to in headings as follows: High school mathematics-science averages by H.S.A., Iowa Physics Aptitude test by I.P.A., Iowa Mathematics Aptitude by I.M.A., Thurstone's Psychological Test of Mental Ability by T.P.T., and Lee-Thorpe Occupational Interest Inventory by O.I.I.

3. ACHIEVEMENT RECORDS

Four sets of achievement tests were given to first year engineers throughout the session; two mid-term (November and February) and two term tests (Christmas and Final). The subjects Chemistry 40, Drawing 4, Mathematics 21, Mathematics 22, and Physics 21 were tested in the mid-term examinations. An additional subject, Drawing 2, was included in the Christmas and Final examinations.

For the purposes of this study the criterion of academic achievement in first year engineering will be the arithmetic mean of the scores obtained by each student in the six courses of the final examinations. However, it is felt that the Christmas averages may be useful as a check on the criterion. Since Drawing 2 was omitted from the mid-term tests and since these tests are usually of a less searching and comprehensive nature, the results from them have not been used in this study.

4. THE SELECTION OF SUBJECTS

First year engineering students who met the following requirements made up the experimental group for this study:

a. The student must have written all the predictive tests at the beginning of the session.

b. He must have written all tests in the Christmas and Final set of examinations.

c. He must have written his Grade XII examinations in Alberta schools.

d. He must have taken only first year engineering courses.

Altogether there were one hundred seventy-six students registered in first year engineering and of these one hundred sixteen qualified for inclusion in the experimental group. For the purposes of this study, it is assumed that the sampling distribution of final average scores for first year engineering students is normal. It is further assumed that the distribution of final average scores obtained by the experimental group is representative of those obtained by all first year engineers in the final examinations.

If this distribution is fitted to a normal curve and chi-square calculated, it is found that a value of chi-aquare at least as great as that obtained here could be expected in approximately sixty per-cent of all samples (N = 116), drawn at random from a normal universe.

TABLE IV

CHI-SQUARE FOR THE DISTRIBUTION OF FINAL AVERAGE SCORES FITTED TO A NORMAL CURVE

Number of cells	Chi-square	Degrees of Freedom	P
10	5.3	7	0.62

The results of this test give no reason to suspect the hypothesis that this distribution is representative of final average scores obtained by all first year engineering students.

5. STATISTICAL PLAN

The statistical procedure followed in the attempt to solve the problem and validate the results is given below.

a. The means and standard deviations for all sets of data were computed.

b. The product-moment correlation coefficients between each of the predictive tests and both sets of data for academic achievement were then calculated and their significance checked. It is assumed that the relationship which existed, if any, between the various predictive tests and the criterion was linear and that the results are derived from a random sample of a normal universe.

c. In the case where the correlation coefficients between a particular predictive test and the Christmas averages differed from that found for the same test and the final averages, an appropriate test for the significance of the difference was applied. This procedure was intended to serve as a check on the criterion, final averages.

d. Appropriate tests of significance for the difference in correlation coefficients found between each useful test of the battery and the criterion of achievement were applied.

e. Multiple correlation coefficients for a combination of two predictive tests of the battery were calculated in order to find the two tests which, when combined, would give the best prediction of achievement in first year engineering.

CHAPTER IV

THE TEST BATTERY, ACHIEVEMENT TESTS AND THEIR RELATION TO EACH OTHER

1. MEANS AND STANDARD DEVIATIONS

The means and standard deviations serve to summarize the distributions obtained by the experimental group on all tests.

TABLE V

MEANS AND STANDARD DEVIATIONS FOR THE DISTRIBUTIONS OF SCORES OF THE TESTS IN THE BATTERY

	H.S.A.	I.P.A.	I.M.A.	T.P.T.	O.I.I.		
					Level	Scien.	Comput.
X	73.3	69.0	92.1	119.2	74.5	30.5	8.9
σ	9.1	10.0	19.0	18.2	6.8	4.5	2.8

TABLE VI

MEANS AND STANDARD DEVIATIONS FOR THE DISTRIBUTIONS OF SCORES OF THE ACHIEVEMENT TESTS

	Christmas Averages	Final Averages
X	58.9	61.5
σ	13.6	13.3

2. CORRELATION COEFFICIENTS

The product-moment correlation coefficients between the predictive tests and the achievement records in first year engineering are presented in the following table. All coefficients are given to the nearest hundredth.

TABLE VII

CORRELATION COEFFICIENTS BETWEEN THE PREDICTIVE TESTS AND THE TWO ACHIEVEMENT TESTS

	H.S.A.	I.P.A.	I.M.A.	T.P.T.	O.I.I.		
					Level	Scien.	Comput.
Christmas Averages	0.65	0.49	0.37	0.37	-0.06	0.09	-0.05
Final Averages	0.66	0.55	0.41	0.37	-0.06	0.04	0.00

3. SIGNIFICANCE OF THE CORRELATION COEFFICIENTS

The decision as to whether or not the correlation coefficients are significant will be based on the tenets of the null hypothesis. If the T ratio, the correlation coefficient divided by the standard error of the correlation coefficient, exceeds 2.5 the null hypothesis will be rejected. A T ratio of 2.5 is roughly the 1% level of significance. If the T ratio lies between 2 and 2.5, the significance of the correlation coefficient will be considered doubtful. For a T ratio of less than 2, which is approximately the 5% level of significance, the null hypothesis will be accepted as tenable. In other words, a value of less than 2 for the T ratio will indicate that the correlation coefficient cannot be considered significantly different from zero.

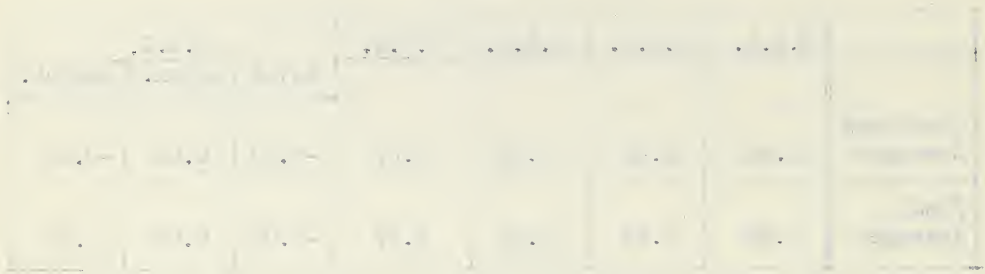

TABLE VIII

SIGNIFICANCE OF THE CORRELATION COEFFICIENTS BETWEEN THE PREDICTIVE TESTS AND THE ACHIEVEMENT RECORDS

Tests Compared	r	$\sigma_r = \frac{1 - r^2}{\sqrt{116}}$ *	T ratio	Significance
Christmas Averages and H.S.A.	0.65	0.054	12.0	very sig.
Christmas Averages and I.P.A.	0.49	0.071	6.9	very sig.
Christmas Averages and I.M.A.	0.37	0.080	4.7	very sig.
Christmas Averages and T.P.T.	0.37	0.080	4.7	very sig.
Christmas Averages and O.I.I. (Level)	-0.06	0.093	0.7	not sig.
Christmas Averages and O.I.I. (Scien.)	0.09	0.092	1.0	not sig.
Christmas Averages and O.I.I. (Comput.)	-0.05	0.093	0.5	not sig.
Final Averages and H.S.A.	0.66	0.052	13.0	very sig.
Final Averages and I.P.A.	0.55	0.065	8.5	very sig.
Final Averages and I.M.A.	0.41	0.077	5.3	very sig.
Final Averages and T.P.T.	0.37	0.080	4.7	very sig.
Final Averages and O.I.I. (Level)	-0.06	0.093	0.7	not sig.
Final Averages and O.I.I. (Scien.)	0.04	0.093	0.4	not sig.
Final Averages and O.I.I. (Comput.)	0.00	0.093	0.0	not sig.

* Yule, G. U. and Kendall, M. G. - " An Introduction to the Theory of Statistics." Page 407. London: Charles Griffen and Co., 1940.

Summary

1. None of the categories of the Lee-Thorpe Occupational Interest Inventory yielded correlation coefficients significantly different from zero when compared with the criterion of achievement.

2. The order of merit of the remaining predictive tests based on the magnitude of their correlation coefficients with the criterion is:

   a. High school mathematics-science averages

   b. Iowa Physics Aptitude Test

   c. Iowa Mathematics Aptitude Test

   d. Thurstone's Psychological Test of Mental Ability.

CHAPTER V

SIGNIFICANCE OF DIFFERENCES BETWEEN CORRELATION COEFFICIENTS

The general formula by which the signifance of differences between correlation coefficients is generally calculated (1) could not be used here. In this study the sample is dependent and in all cases one array is common to the two sets of bi-variates. An appropriate test for these conditions is discussed fully in Peatman (1), pages 420-22. In order that this test may be used it is necessary that the correlation coefficients between each pair of predictive tests and between the achievement tests be found. These coefficients are shown in the table below.

TABLE IX

CORRELATION COEFFICIENTS BETWEEN THE VARIOUS TESTS OF THE BATTERY AND BETWEEN THE ACHIEVEMENT RECORDS

	Final Averages	I.P.A.	I.M.A.	T.P.T.
Christmas Averages	0.91			
H.S.A.		0.48	0.44	0.27
I.P.A.			0.40	0.57
I.M.A.				0.61

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(1) $$\sigma^2_{r_{12}-r_{34}} = \left(\frac{1 - r^2_{12}}{\sqrt{N_{12}}}\right)^2 + \left(\frac{1 - r^2_{34}}{N_{34}}\right)^2$$

The same courses were tested on the Christmas and final examinations; therefore both measurements of achievement are directly comparable. The differences for correlation coefficients found between a predictive test and the Christmas averages and between the same test and the final averages will be tested. This will serve to indicate whether there are any significant trends in the magnitude of the correlation coefficients between the various predictive tests and achievement tests given at different times. The results of this procedure are shown in the table below.

TABLE X

SIGNIFICANCE OF THE DIFFERENCE FOR CORRELATION COEFFICIENTS BETWEEN THE PREDICTIVE TESTS AND CHRISTMAS AND FINAL AVERAGES

Predictive Test	Achievement Record	r	Difference	σ_{r-r}	T/ratio	Signif.
H.S.A.	Xmas Average Final Average	0.65 0.66	-0.01	0.028	0.4	not sig.
I.P.A.	Xmas Average Final Average	0.49 0.55	-0.06	0.034	1.7	not sig.
I.M.A.	Xmas Average Final Average	0.37 0.41	-0.04	0.035	1.1	not sig.
T.P.T.	Xmas Average Final Average	0.37 0.37	0.00	-	-	not sig.

Since the final marks are the criterion of success or failure in the Faculty of Engineering, the average of these scores have been taken as the criterion of achievement in first year engineering for the purposes of this study. To find the order of merit of the predictive tests in forecasting achievement in first year engineering

it will be necessary to test the significance of the differences between correlation coefficients found for each of the tests and the criterion of achievement, final averages.

TABLE XI

SIGNIFICANCE OF DIFFERENCES FOR CORRELATION COEFFICIENTS BETWEEN THE CRITERION AND VARIOUS TESTS OF THE BATTERY

Test	r	Difference	σ_{r-r}	T ratio	Significance
H.S.A.	0.66	0.11	0.067	1.6	not sig.
I.P.A.	0.55				
H.S.A.	0.66	0.25	0.076	3.3	sig.
I.M.A.	0.41				
H.S.A.	0.66	0.29	0.082	3.5	sig.
T.P.T.	0.37				
I.P.A.	0.55	0.14	0.083	1.7	not sig.
I.M.A.	0.41				
I.P.A.	0.55	0.18	0.070	2.6	sig.
T.P.T.	0.37				
I.M.A.	0.41	0.04	0.075	0.1	not sig.
T.P.T.	0.37				

Summary

1. None of the predictive tests, when correlated with the Christmas averages, yields a correlation coefficient significantly different from that found for the same test on the final averages. Thus, assuming that these achievement tests are equally valid, there is no significant trend in the magnitudes of any of the correlation coefficients for the period between the tests.

2. The correlation coefficient found between the high school average scores and the criterion is significantly greater than the correlation coefficients for the criterion and the Iowa Mathematics Aptitude test and Thurstone's Psychological test. For the experimental group, the linear relationship between scores on the Iowa Physics test and final averages was found to be significantly greater than that between scores on the Thurstone Psychological test and the final averages. Any other comparison of the predictive tests indicates that the correlation coefficients with the criterion are not significantly different from each other.

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CHAPTER VI

METHODS OF MAKING THE PREDICTION OF ACADEMIC ACHIEVEMENT

1. THE PROBLEM OF PREDICTION

The correlation coefficients which have been found reveal only the extent to which the tests of the battery and the criterion of achievement in first year engineering are related. To make an estimate of expected average scores in first year engineering the equation of the regression line of the final average scores on the predictive test scores must be obtained. An inspection of the scatter diagrams in the appendix will reveal that there is wide variation of the obtained scores from this regression line. The greater this variation the more caution must be used in predicting a final average score.

It is usually possible to increase predictive efficiency by finding multiple correlation coefficients between a combination of two or more predictive tests and the criterion. Generally speaking, these coefficients will be larger than the linear correlation coefficients found between any one test used in the combination and the criterion. A composite weighted score for the combination can be found for each individual and the regression equation can be found for this group. The estimate of a final average score from this equation may be made with more confidence than one made on the basis of marks obtained in only one of the predictive tests.

2. REGRESSION EQUATIONS OF SINGLE PREDICTORS

In order that the final average score in first year engineering may be estimated from the score on any of the predictive tests, the regression equations have been calculated. The following table shows the required regression equation, the standard error of estimate, and the predictive efficiency for each test of the battery. Since none of the categories of the Lee-Thorpe Occupational Interest Inventory was found to have any predictive value, they will not be included.

TABLE XII

PREDICTION OF ACHIEVEMENT IN FIRST YEAR ENGINEERING FROM THE INDIVIDUAL TESTS OF THE BATTERY

Test	r with final	Regression Equations *	Standard Error of Estimate	Efficiency
High school Averages	0.66	$X_{12} = 0.96X_2 - 9.0$	10.0	25%
Iowa Physics Aptitude	0.55	$X_{12} = 0.72X_2 + 12.0$	11.1	17%
Iowa Mathematics Aptitude	0.41	$X_{12} = 0.28X_2 + 35.7$	12.2	9%
Thurstone's Psychological	0.37	$X_{12} = 0.28X_2 + 28.7$	12.3	7%

* General Form for Regression Equation of X_1 on X_2,

$$X_{12} = \overline{X}_1 + b_{12}(X_2 - \overline{X}_2)$$

An example will serve to illustrate the use of the regression equation in making an estimate of the expected final average score in first year engineering. The regression equation for predicting the final average score from high school averages is: $X_{12} = 0.96X_2 - 9.0$. Suppose an individual has a high school mathematics-science average of 85. This number is substituted for X_2 in the regression equation. Thus the estimated final score in first year engineering, X_{12}, is 72.6. Approximately 68% of all such predictions could be expected to fall within the limits 62.6 to 82.6 providing all cases in the particular column in the scatter diagram are distributed normally. An estimate on the basis of high school averages could be considered to be 25% more efficient than a guess. This measure of predictive efficiency, first used by C. Hull, is the proportionate reduction of error of estimate from the maximum error observed when the correlation is zero.[1]

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[1] Pages 459-60, Peatman (1)

3. USE OF MULTIPLE CORRELATION IN PREDICTION

An attempt has been made to increase the predictive efficiency of the test battery by combining pairs of predictive tests using the multiple correlation technique outlined by Peatman (1), pages 482-85. The results of this procedure are shown in the table below.

TABLE XIII

MULTIPLE CORRELATION COEFFICIENTS WITH THE CRITERION WHEN TWO PREDICTIVE TESTS ARE COMBINED

Combination of Predictive Tests	R
High school averages and Iowa Physics Aptitude	0.71
High school averages and Iowa Mathematics Aptitude	0.67
High school averages and Thurstone's Psychological	0.69
Iowa Physics Aptitude and Iowa Mathematics Aptitude	0.59
Iowa Physics Aptitude and Thurstone's Psychological	0.55
Iowa Mathematics Aptitude and Thurstone's Psychological	0.42

The highest predictive efficiency obtainable by this procedure is given when the results of the Iowa Physics Aptitude test and the high school averages are combined. If the results of each of these tests are expressed as standard measures, the weights required for the scores on each test to give a linear correlation coefficient of 0.71 may be calculated.[1] The procedure indicates that the indivi-

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[1] Page 484, Peatman (1)

dual standard score on the Iowa Physics Aptitude test should be given approximately three-fifths as much weight as those of the high school averages.[1]

Providing the distribution of scores on each test is nearly normal, the original scores will be approximately proportional to the standard scores. Thus only a small error will be introduced if the original scores are given their found weights and the sum of these taken as the predictive scores. If it is assumed that the distributions of scores on the Iowa Physics Aptitude test and the high school averages approach the normal form the original scores on each may be weighted in the following manner: high school averages multiplied by 1, and the Iowa Physics Aptitude test scores by 0.6 The set of data obtained by this procedure for the experimental group, when correlated with the final average scores, yields a coefficient of 0.70. The regression equation for predicting final average scores was found to be: $X_{12} = 0.67X_2 - 16.0$. The procedure as outlined here saves the labor of transforming scores to their standard form and, providing the distribution of scores on each test does not deviate too far from the normal form, gives only a slightly smaller correlation coefficient than that obtained by multiple correlation.

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[1] The regression equation for weighting, $\bar{t}_c = 0.52t_x - 0.30t_y$

Where t_c = the estimated standard score.

t_x = the high school average (standard) score.

t_y = the Iowa Physics (standard) score.

Summary

1. High school mathematics-science averages were found to be the best single predictor of final average scores in first year engineering. A prediction made on the basis of high school mathematics-science averages in approximately 25% better than a guess.

2. The highest multiple correlation coefficient for any two of the predictive tests with the criterion was found when high school mathematics-science average scores and Iowa Physics Aptitude test scores were combined. The predictive efficiency of the combination is approximately 29% better than a guess.

BIBLIOGRAPHY

1. Peatman, J. G. - " Descriptive and Sampling Statistics. "
New York: Harper Brothers, 1947.

CHAPTER VII

CONCLUSIONS AND IMPLICATIONS

1. CONCLUSIONS

The general conclusions which may be drawn from the findings of this study follow.

a. The categories, 'Level of Interest', 'Scientific', and 'Computational' of the Lee-Thorpe Occupational Interest Inventory were found to have no value in predicting subsequent academic achievement of the experimental group.

b. High school mathematics-science averages and the Iowa Physics Aptitude test were found to be the best individual tests of the battery for predicting academic achievement in first year engineering.

c. For this group, a prediction made on the basis of the weighted scores of the high school mathematics-science averages and the Iowa Physics Aptitude test combined is approximately 29% better than a guess. This was the highest predictive efficiency found for the battery.

d. A prediction of academic achievement in first year engineering based on high school averages alone was found to be approximately 25% better than a guess.

2. IMPLICATIONS

This study is the first of its kind to be conducted in an attempt to find the value of predictive tests in forecasting academic achievement in first year engineering at the University of Alberta. The number of cases in the experimental group was small and the procedures used were elementary. It has, however, been quite definitely established that the Lee-Thorpe Occupational Interest Inventory should be deleted from the test battery. The findings also indicate that high school averages predict achievement in first year engineering as well as do the scores on any of the other predictive tests used and better than most of them.

This study has not established whether or not a minimum high school average for admission to the Faculty of Engineering would reduce failures. An inspection of the scatter diagram in the appendix for the high school mathematics-science averages and final average scores in first year engineering suggests that further study with more cases may reveal important implications in this connection.

Although it is beyond the scope of this particular study, it might be suggested that investigations in the future attempt to use multiple correlation techniques to find a weighted composite score for all tests of the battery. This would increase the overall predictive efficiency of the battery and would simplify measures taken to predict academic achievement.

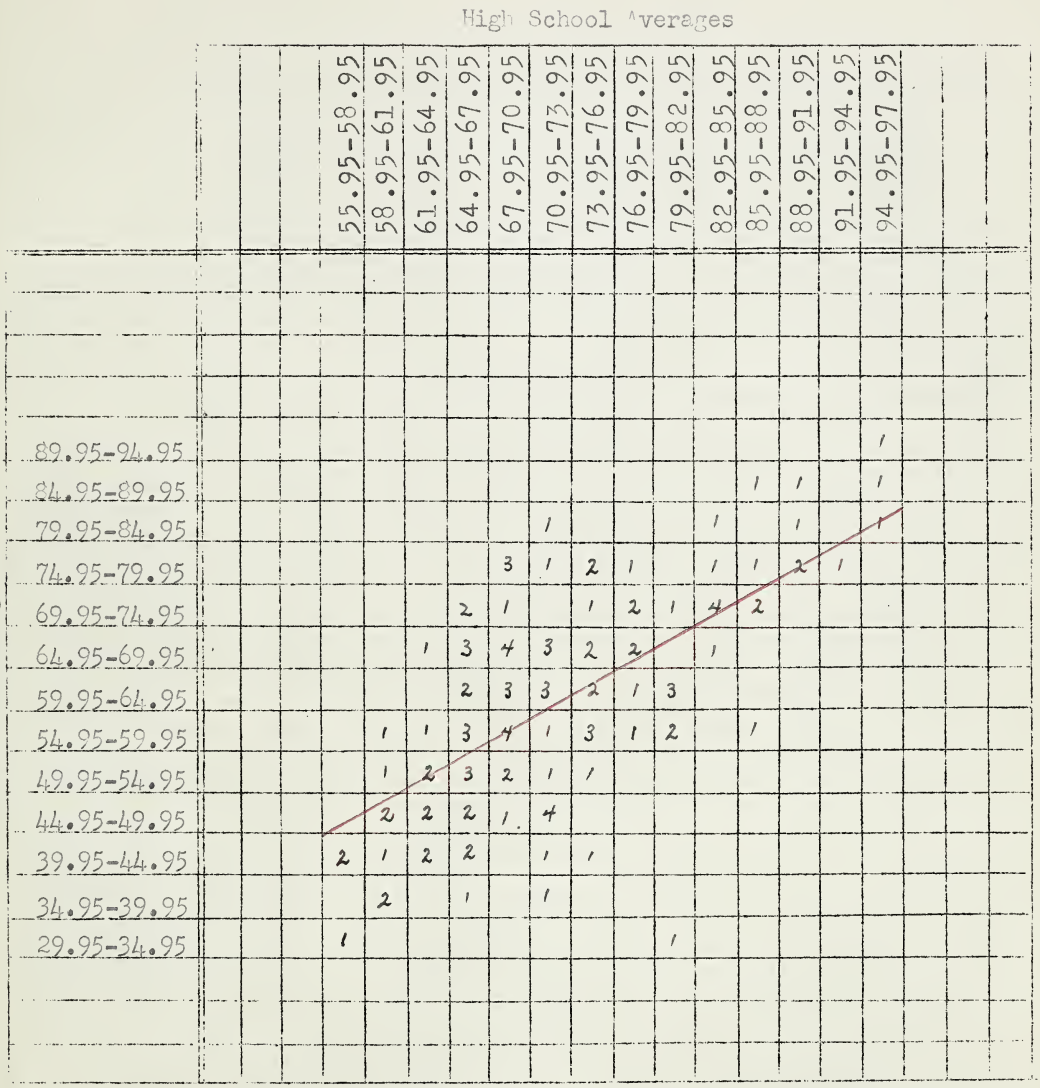
The findings of this study make it possible to estimate roughly academic achievement in first year engineering, given scores from the predictive tests. These estimates are useful for guidance purposes, but are not sufficiently accurate to reveal clearly which candidates will be successful in the freshman year.

APPENDIX

SCATTER DIAGRAMS

FINAL AVERAGE SCORES IN FIRST YEAR ENGINEERING AGAINST

HIGH SCHOOL MATHEMATICS-SCIENCE AVERAGES



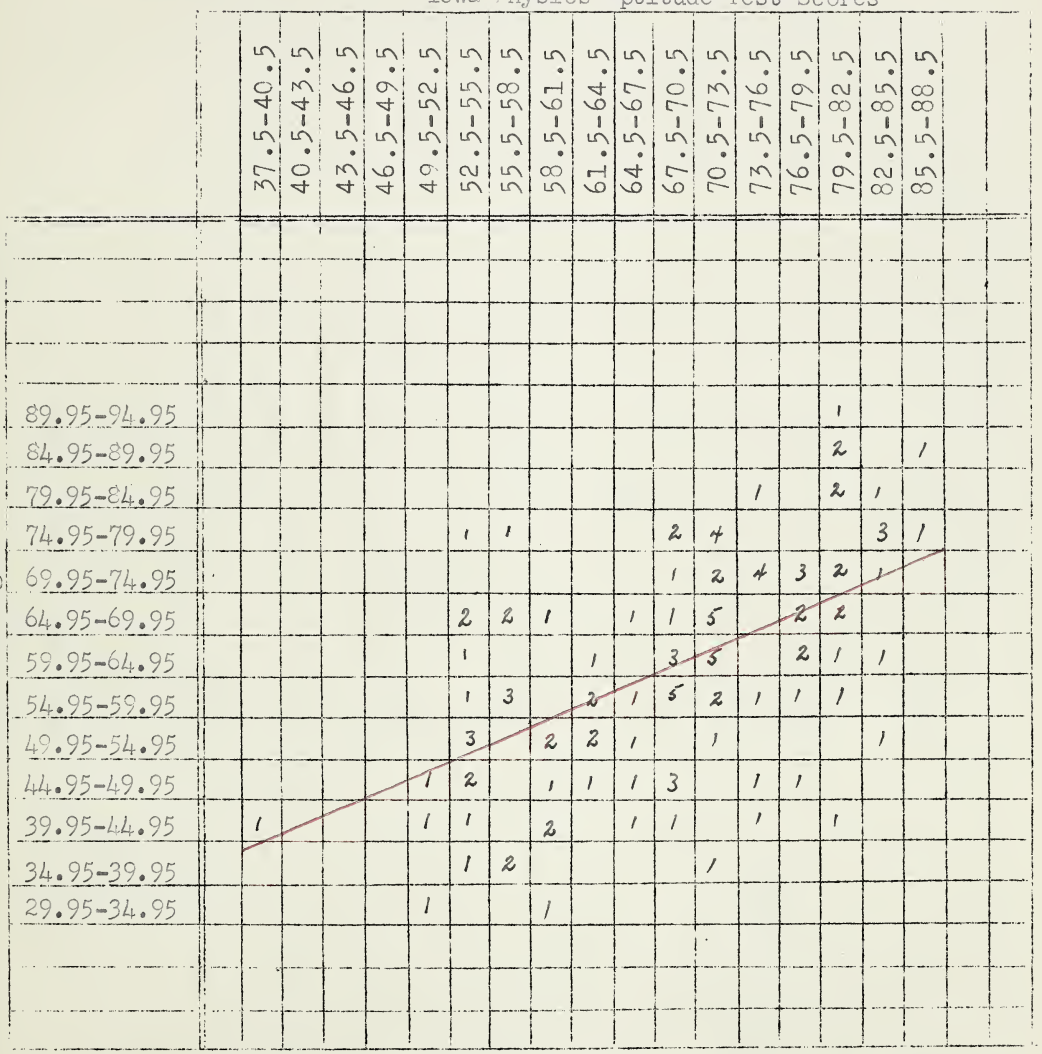
N= 116

(REGRESSION EQUATION FOR ESTIMATING FINAL AVERAGE SCORES

IN FIRST YEAR ENGINEERING; $X_{12} = 0.96X_2 - 9.0$)

FINAL AVERAGE SCORES IN FIRST YEAR ENGINEERING AGAINST

IOWA PHYSICS APTITUDE TEST SCORES



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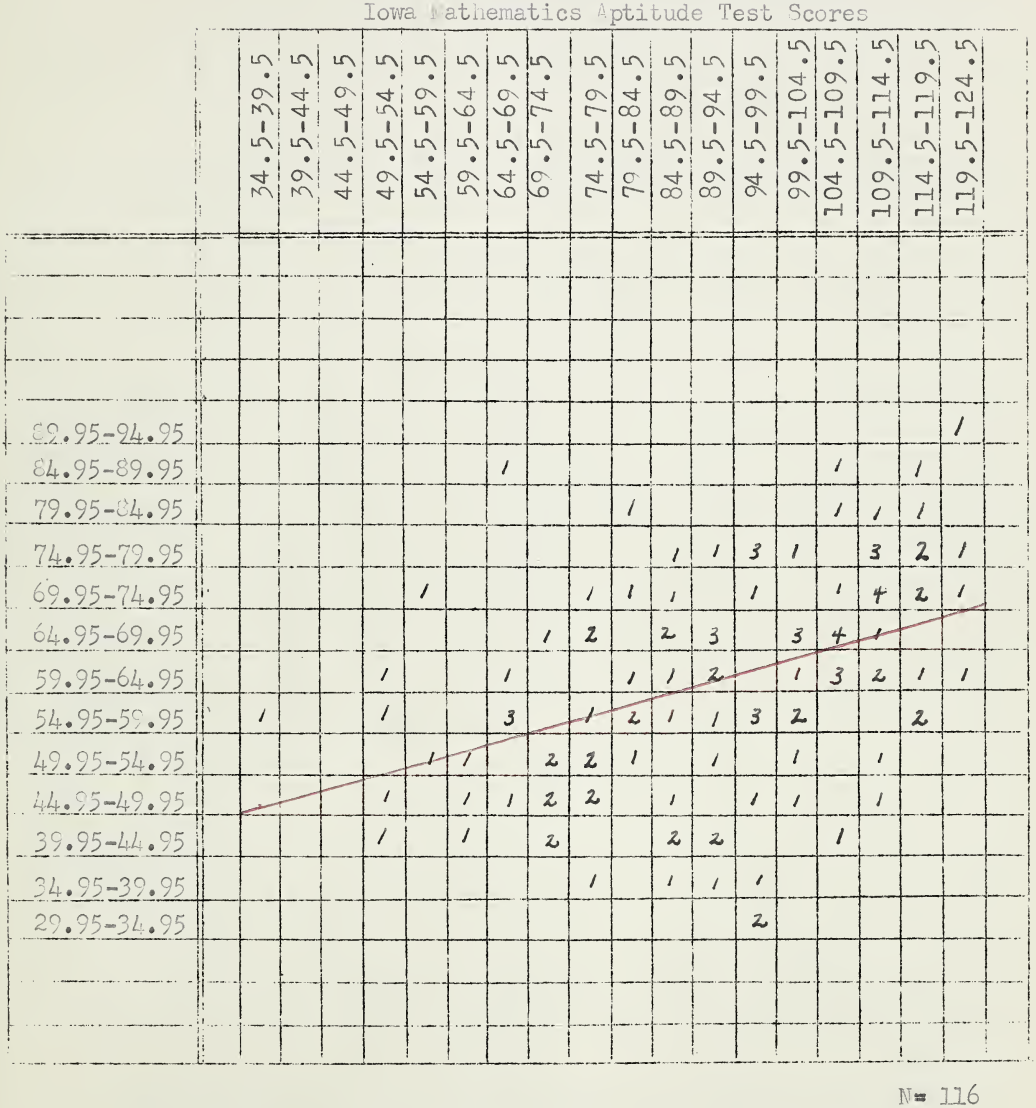
(REGRESSION EQUATION FOR ESTIMATING FINAL AVERAGE SCORE

IN FIRST YEAR ENGINEERING; $X_{12} = 0.72X_2 + 12.0$)

FINAL AVERAGE SCORES IN FIRST YEAR ENGINEERING AGAINST

IOWA MATHEMATICS APTITUDE TEST SCORES



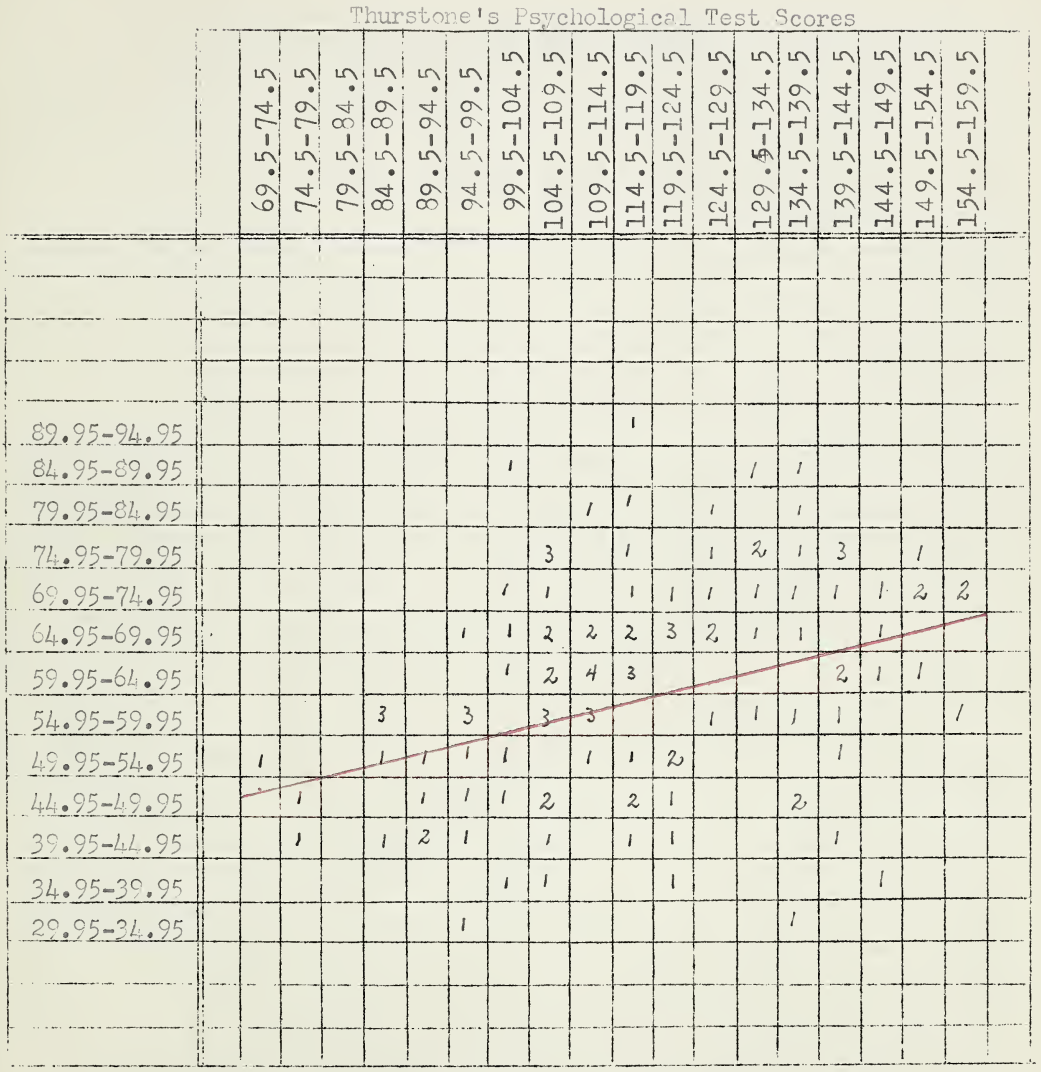
N= 116

(REGRESSION EQUATION FOR ESTIMATING FINAL AVERAGE SCORES

IN FIRST YEAR ENGINEERING; $X_{12} = 0.28X_2 + 35.7$)

FINAL AVERAGE SCORES IN FIRST YEAR ENGINEERING AGAINST

THURSTONE'S PSYCHOLOGICAL TEST SCORES



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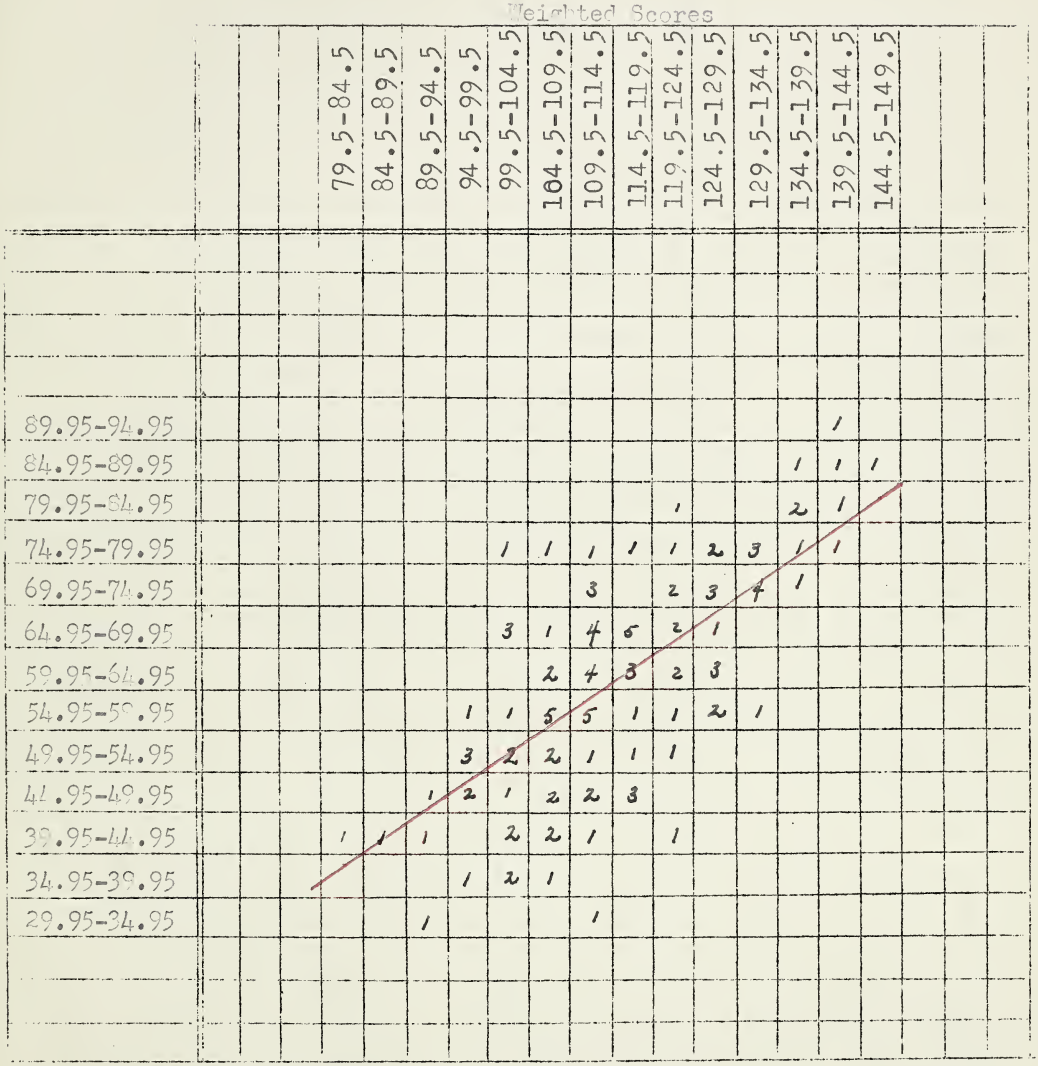
(REGRESSION EQUATION FOR ESTIMATING FINAL AVERAGE SCORES

IN FIRST YEAR ENGINEERING; $X_{12} = 0.28X_2 + 28.7$)

FINAL AVERAGE SCORES IN FIRST YEAR ENGINEERING AGAINST

WEIGHTED HIGH SCHOOL AVERAGES AND IOWA PHYSICS

APTITUDE TEST SCORES



N= 116

(REGRESSION EQUATION FOR ESTIMATING FINAL AVERAGE SCORES

IN FIRST YEAR ENGINEERING; $X_{12} = 0.67X_2 - 16.0$)